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not at all sure that the *inevitable and automatic* end of the social process is increasing installments of justice and greater elevation and expansion of the great masses of men. But I believe *it can be made the end* by steady, persistent preoccupation with the problem, and by that alone. Moreover, I hold it to be neither sacrilege nor lèse majesté to believe that with applied sociology and an education leavened by it rests this problem of harmonizing more closely through enlightened will the facts of social achievement and progressive social welfare.

ALBION W. SMALL

UNIVERSITY OF CHICAGO

The Origin and Evolution of Life. By HENRY FAIRFIELD OSBORN.
New York: Charles Scribner's Sons, 1917. Pp. xxi+322.
\$3.00.

This is a fascinating story, told with simple dignity of style, of the development of life on our planet. In its scope and comprehensiveness the book furnishes a unique survey of the field. As compared with Darwin's epoch-making work, *The Origin of Species*, it shows how far science has traveled under the impulse of Darwin's theory. The author begins his account with the inorganic preparation for life in our solar system and on our planet. On this point he seems in substantial agreement with Professor Lawrence J. Henderson. In tracing the evolution back to the precellular stage of the bacteria and their forerunners he narrows the gulf from the inorganic to the organic and is in sympathy with the view "that adaptation will prove to be a continuation of the previous cosmic order rather than the introduction of a new order of things" (p. 10). He recognizes, however, that any theory to be of value must rest upon "experiment, observation, and research, guided by the imagination and checked by verification." In the vast survey of the development of life-forms from the bacteria to the highest mammals, covering a period of "perhaps a hundred million years," the author shows his mastery of the data now available, particularly the imposing paleontological evidence to which he is a distinguished contributor.

The book, however, is not merely a picturesque exhibit of evidence, but is illumined throughout by hypothesis. Indeed the advance since Darwin is no less striking on the side of hypothesis than in the extension of data. Darwin's great principle of selection by environment stands as an important contribution. But it does not account for the inner dynamics of the life-mechanism. This the author finds, with Weismann, in the heredity chromatin of germ plasm. This, however, is not independent of the three other energy complexes in the author's energy

theory of life, viz., the body chromatin and protoplasm, the inorganic environment, and the life-environment (p. 21). Evolution is the resultant of the action, reaction, and interaction of all four factors. While the author holds that "the development of individual life is an unfolding of the energies taken within the body under the directing agency of the chromatin, and the evolution of life is essentially the evolution of chromatin energies" (pp. 96, 97), he also holds with the prevailing opinion among paleontologists that the chromatin is affected by its interaction with the other energy complexes cited above. "Taking the whole history of vertebrate life from the beginning, we observe that every prolonged, old adaptive phase in a similar habitat becomes impressed in the heredity characters of the chromatin" (p. 152). Though the author denies the inheritance of acquired traits in the sense of consciously acquired habits, it would seem that his theory steers a middle ground between extreme Weismannism and Lamarckism. As regards the direction of the life-process the author seems to take a middle ground between the chance theory of the pure Darwinians and the theories which add a directing entelechy (Driesch) or *elan vital* (Bergson) to the chemical process. While a small proportion of the facts seem to conform to the salutary conception (DeVries), the author holds to the continuity hypothesis for the large mass of the facts. There is an inner predetermination in the heredity chromatin which makes it seem as though characters were latent, waiting to be called forth, and many new characters definitely appear and take an adaptive direction from the start (the law of rectigradation, p. 252). The process of evolution is an orderly process, but the order is immanent in the cosmic process itself. In this sense the author quotes Aristotle approvingly: "Nature produces those things which, being continually moved by a certain principle contained in themselves, arrive at a certain end" (p. 9). While the author's theory, therefore, is that of chemism and mechanism, it is not materialism in the antiteleological sense. The question might be raised whether the author is not overworking the heredity chromatin, the relation of which to the protoplasm and body chromatin the author himself frankly acknowledges to be unknown. The author's empirical results could no doubt be stated just as well, and perhaps with even greater consistency, without this speculative emphasis. But his position is after all the orthodox one in biological science just now.

J. E. BOODIN